MAGNETIC BEARING ASSEMBLY

FIELD OF THE INVENTION

The present invention relates to a magnetic bearing assembly, and more particularly to a magnetic bearing assembly capable of generating radially and axially repulsive magnetic fields.

BACKGROUND OF THE INVENTION

A bearing is customarily used to support a rotating shaft of a motor when a rotor rotates around the stator circumferentially.

There are two general types of bearings: a ball bearing and a self-lubricating bearing.

Please refer to Figs. 1(a) and 1(b). The ball bearing includes mainly an inner ring 13 which includes a groove as a raceway, an outer ring 12 which also includes a groove as a raceway and a plurality of steal balls 11 which are inserted between respective grooves of the inner and outer rings. The inner ring 13 is usually fixed to a rotary shaft 21 of a rotor, and the outer ring 12 is fixed to a base or a stator 23. The upper side of the ball bearing is urged against a spring 22 for facilitating smooth rotation.

Upon rotating the shaft, the balls of the ball bearing race around the grooves inward the outer ring 12 and outward the inner ring 13. After the ball bearing is used for a certain period of time, the fatigue of the metal material is customarily found, thereby causing the balls and the surface of the inner ring or the outer ring to be abraded.

Referring to Figs. 2(a) and 2(b), a self-lubricating bearing manufactured of polymeric material is usually in a shape of a sleeve 3 and it contains minute passages or channels carrying therein the

lubricating oil 31 such that the oil can be deposited on the shaft 21 by diffusion into the inner wall 32 upon rotation of the shaft 21. The inner wall 32 of the self-lubricating bearing usually contacts with a rotary shaft 21, and the outer wall 33 is fixed to a base or a stator 23.

In contrast, the ball bearing can perform under heavy loads and has a long life; however, it is costly and has the disadvantage of being abraded. The self-lubricating bearing has good self-lubricating properties to reduce abrasion and is cheaper than the ball bearing; however, it generally incapable of being operated with large loads and its life is not very long.

It is therefore tried by the present invention to overcome the problems described above.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a magnetic bearing assembly having an extended lifetime.

It is further an object of the present invention to provide a magnetic bearing assembly having a low cost.

The magnetic bearing assembly according to the present invention comprises a magnetic portion connected to a shaft and a base for generating a repulsive magnetic field and a bearing portion connected to the shaft and the base for supporting said shaft upon rotation of the shaft.

Certainly, the repulsive magnetic field can be one of a radially repulsive magnetic field and an axial repulsive magnetic field.

Preferably, the bearing portion is a sleeve bearing.

Preferably, the base is a stator of a motor.

In an aspect of the present invention, the magnetic portion includes an upper magnetic portion and a lower magnetic portion, wherein the

upper magnetic portion and the lower magnetic portion are disposed symmetrically and each includes a first magnetic ring, a second magnetic ring and a third magnetic ring. The first magnetic ring and the second magnetic ring are connected to the shaft, and the third magnetic ring is connected to the base. The second magnetic ring and the third magnetic ring are disposed in radial alignment with each other to have like polar disposition. The first magnetic ring and the second magnetic ring are disposed in axial alignment with each other to have opposite polar disposition.

In another aspect of the present invention, the magnetic portion includes an upper magnetic portion and a lower magnetic portion, wherein the upper magnetic portion includes an inner magnetic ring and an outer magnetic ring and the lower magnetic portion includes a first magnetic ring, a second magnetic ring and a third magnetic ring. The inner magnetic ring and the outer magnetic ring are disposed in radial alignment with each other to have like polar disposition. The first magnetic ring and the third magnetic ring are connected to the shaft and the second magnetic ring is connected to the base. The first magnetic ring, the second magnetic ring and the third magnetic ring are disposed in radial alignment with each other to have opposite polar disposition.

The above objects and advantages of the present invention will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed description and accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1(a) is a sectional view of a customarily used ball bearing;

Fig. 1(b) shows a schematic view for an application of a customarily

used ball bearing;

Fig. 2(a) is a sectional view of a customarily used self-lubricating bearing;

Fig. 2(b) shows a schematic view for an application of a customarily used self-lubricating bearing;

Fig. 3 is a schematic view of the magnetic bearing assembly according to a first embodiment of the present invention; and

Fig. 4 is a schematic view of the magnetic bearing assembly according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 3 is a schematic diagram of the magnetic bearing assembly according to the first embodiment of the present invention. The magnetic bearing assembly includes a magnetic portion and a bearing portion. The bearing portion is a sleeve bearing 5. The magnetic portion comprises an upper magnetic portion comprising three magnetic rings, i.e. 51, 52 and 53, and a lower magnetic portion comprising three magnetic rings, i.e. 511, 521 and 531. In the upper magnetic portion, the first magnetic ring 51 and the second magnetic ring 52 are connected to the stator 23 and the third magnetic ring 53 is connected to the shaft 21. The second magnetic ring 52 and the third magnetic ring 53 are disposed in radial alignment, wherein these two rings are assembled with each other to have the like polar disposition for generating repulsive magnetic field. In addition, the first magnetic ring 51 and the second magnetic ring 52 are disposed in axial alignment to have opposite polar disposition for generating an axially repulsive magnetic field. The radially repulsive magnetic field, generated between the second magnetic ring 52 and the third magnetic ring 53, and the axially repulsive

magnetic field, generated between the first magnetic ring 51 and the second magnetic ring 52, allow to reduce friction between the sleeve bearing 5 and the shaft 21 upon rotation of the shaft. The same situation may be deduced by analogy that the three magnetic rings 511, 521 and 531 in the lower magnetic portion facilitate reducing friction between the sleeve bearing 5 and the shaft 21 upon rotation.

Fig. 4 is a schematic diagram of the magnetic bearing assembly according to the second embodiment of the present invention. The magnetic bearing assembly includes a magnetic portion and a bearing portion. The bearing portion is a sleeve bearing 5. The magnetic portion comprises an upper magnetic portion having two magnetic rings, i.e. an inner magnetic ring 73 and an outer magnetic ring 74, and a lower magnetic portion having three magnetic rings, i.e. 75, 76 and 77. In the upper magnetic portion, the inner magnetic ring 73 is connected to the shaft 21 and the outer magnetic ring 74 is connected to the stator 23. These two magnetic rings 73 and 74 are disposed in radial alignment with each other to have like polar disposition for generating repulsive magnetic field. In the lower magnetic portion, the first magnetic ring 75 and the third magnetic ring 77 are connected to the shaft 21 and the second magnetic ring is connected to the stator 23. These three magnetic rings 75, 76 and 77 are disposed in axial alignment to have opposite polar disposition for generating axially repulsive magnetic fields. Therefore, the friction between the sleeve bearing 5 and the shaft 21 upon rotation is considerably reduced.

The magnetic bearing assembly according to the present invention provides substantially frictionless rotation. Thus, it requires no lubrication, results in less abrasion and produces low noise, all of which

contribute to extend the operating life of the bearing. Furthermore, the magnetic rings can be made of plastic magnet for reducing the cost of production and the cost of the magnetic bearing assembly is close to the self-lubricating bearing.

While the foregoing has been described in terms of preferred embodiments of the invention, it will be appreciated by those skilled in the art that many variations and modifications may be made without departing from the principles and spirit of the invention, the scope of which is defined by the appended claims.